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ABSTRACT

This paper presents an experimental investigation of the causes and accuracy of adolescents' judgments regarding the likelihood of obtaining a high status occupation. High school students were asked to estimate the probability that a fictitious target subject would actually achieve the goal of becoming a doctor. Information about job availability and target subject characteristics were varied across experimental conditions. Three conclusions are indicated. First, high school students' probability judgments about high status career attainment are unrealistic. Second, probability judgments are responsive to the presentation of information about job availability, but on average such judgments are still unrealistic even when this information is provided to students. Third, probability judgments are distorted in a self-serving manner when the students who rate the odds of career attainment themselves aspire to that career. Findings suggest that adolescents may overaspire in their career expectations because they reason inaccurately about the difficulty of attaining high-status jobs. Implications for career counseling suggest that simply giving students labor market information may be insufficient to foster more realistic ideas about careers. The paper notes the need for a didactic technique that can impress upon students the logical relationship between frequency information and subjective degrees of confidence in the likelihood of single events. (Contains 11 references, 2 tables, and 1 figure.) (JDM)

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ED 433 482

Running head: INACCURATE REASONING IN CAREER OVERASPIRATION

An Experimental Investigation of Career Attainment Probability Judgments: The Role of Inaccurate Reasoning in Career Overaspiration

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May 4, 1999

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Abstract

This paper presents an experimental investigation of the causes and accuracy of adolescents' judgments regarding the likelihood of obtaining a high status occupation. High school students were asked to estimate the probability that a fictitious target subject would actually achieve the goal of becoming a doctor. Information about both job availability and characteristics of the target subject were varied across experimental conditions. The results indicate that students' probability estimates are in general unrealistic. Probability judgments are responsive to the presentation of labor market information, but on average such judgments are still unrealistic even when this information is available. These findings suggest that adolescents may overaspire in their career expectations in large part because they reason inaccurately about the relative difficulty of obtaining high status jobs.

An Experimental Investigation of Career Attainment Probability Judgments: The Role of Inaccurate Reasoning in Career Overaspiration

May 4, 1999

Previous researchers have consistently found that American adolescents tend to overaspire in their occupational expectations and aspirations (Bidwell, Csikszentmihalyi, Hedges, & Schneider, 1998; Gottfredson, 1979; Gottfredson, Holland, & Gottfredson, 1975; Jacobs, Karen, & McClelland, 1991; Merton, 1968). Jacobs et al. (1991), for example, found that 86% of young men in a national sample aspired to a professional occupation at least once between the ages of 15 and 27, while only 21% actually obtained a professional job by age 30. Results from other large surveys also demonstrate large mismatches between the distribution of career aspirations among young adults and the actual distribution of occupations in the labor force (Gottfredson, 1979; Gottfredson et al., 1975). Similarly, more recent data from a nationally representative sample found that 10% of high school students expect to become doctors despite the fact that physicians constitute less than one percent of all full-time workers (Bidwell et al., 1998).

Two explanations for this pattern of "overaspiration" seem intuitively plausible. First, adolescents may possess inaccurate ideas about the relative difficulty of obtaining high status jobs. Alternatively, adolescents may intentionally aim high as a means of obtaining the highest status jobs possible. That is, students may be aware of the long odds against achieving certain careers but aspire to them anyway. Neither the distinction between expectations and aspirations nor subjective estimates of certainty (e.g., survey items such as, "how certain are you that you will obtain this career?") can clearly

distinguish between the two proposed explanations for overaspiration. This is because certainty judgments may reflect either beliefs about the job market or students' beliefs that they can "beat the odds" and obtain their desired careers. The latter reasoning seems especially likely given the apparently widespread attitude that personal will is the primary determinant of success (see Merton, 1968).

The two explanations for overaspiration might be disentangled were students to estimate the probability that a stranger will obtain a high status job. If adolescents possess accurate ideas about the job market but overaspire as an expression of self-confidence, then estimates of the odds that a stranger will obtain a high status job should be more realistic. Alternatively, if adolescents possess inaccurate ideas about the job market, then probability estimates with regard to a stranger should still be inaccurate. One objective of the current experiment is a determination of which of these two scenarios is more likely to be correct.

If probability judgments regarding career attainment are found to be inaccurate, this still leaves unknown the source of this inaccuracy. As one possibility, adolescents may simply not possess information relevant to the construction of likelihood estimates for career attainment. As another possibility, students may possess relevant information but fail to draw statistically accurate inferences from that information. By manipulating the information presented to students, the present experiment may shed light on how adolescents use information to draw inferences about the probability of career attainment. This is the second main objective of this study.

Secondary objectives of this study include the identification of other factors that may influence estimates of the probability of career attainment. The effects of gender,

race, social class, and academic achievement were all examined. In addition, the available data allow an examination of whether students who themselves expect to obtain the target career (doctor) produce estimates of a stranger's odds of becoming a doctor that differ from the estimates of those students who do not expect to become physicians.

Method

Participants were drawn from the Sloan Foundation Study of Youth and Social Development (Bidwell et al., 1998). A nationally representative sample of 2250 high school students (10^{th} through 12^{th} grades) completed the experiment as part of a larger survey. Thirteen different high schools across diverse geographic regions of the U.S. were represented in the sample.

Participants were asked to consider the career prospects of a fictitious high school junior (gender unspecified) who had reported a desire to become a doctor. All participants read the following instructions:

> In order to get a sense of how you think about the job market, we would like you to consider the career prospects of a high school junior chosen at random from a previous study. This student reported a desire to become a doctor. We would like to know how likely you think it is that this student actually will become a doctor.

Each participant was randomly assigned to one of eight experimental conditions that differed in the information provided about the target subject and about the number of doctors in the job market. Random assignment was implemented by shuffling the eight versions of the questionnaire before presenting them at the respective high schools. Sample size differences across the experimental conditions are attributable to this

randomization procedure.

In half of the experimental conditions the participants were informed that one out of every 250 full-time workers in the U.S. is a doctor, and that 1 out of 10 high school students reports a desire to become a doctor; in the other half of the conditions the participants were not provided any information about the prevalence of doctors. In half of the conditions the participants read that the target subject has an A average in science courses and ranks near the top of the junior class, while in the other half of the conditions the participants read that the target subject has a B- average in science courses and ranks near the middle of the junior class. Finally, in half of the conditions the participants were informed that the target subject is popular and plays varsity sports, while in the other half they read that the target subject is unpopular and does not participate in extracurricular activities. In sum, the experiment utilized a 2 (base rate of doctors vs. no base rate) x 2 (high vs. low academic success of target) x 2 (high vs. low social involvement of target) between subjects factorial design. The dependent measure was a probability estimate that the target subject actually will become a doctor.

Results

Results from the larger survey were compared across experimental conditions in order to test the adequacy of the randomization procedure. Students' self-reported grade point averages did not differ reliably across the eight experimental conditions, F (7, 1560) = 1.72, $p < .10$.[1] The average social class of the communities from which students were drawn (estimated from Census information; see Bidwell et al., 1998), though, did differ across experimental conditions, F (7, 2242) = 4.20, $p < .001$. This means that certain

versions of the questionnaire were overrepresented at some high schools. Perhaps as a concomitant of the social class effect, students' race (white vs. non-white) was also reliably associated with experimental condition, χ^2 (7) = 24.90, $p < .001$. Although these effects were relatively small in magnitude, they do suggest that the eight versions of the questionnaire were not shuffled well enough to produce completely random assignment.

Two considerations suggest that the departures from random assignment should not distort the conceptual conclusions drawn from the experiment. First, the main statistical conclusions from an analysis of variance computed for the entire sample were replicated when ANOVAs were computed separately for each race and social class category. Second, regression models presented below demonstrate reliable effects of the treatment conditions even when the influence of variables like race, gender, and social class are held constant.

Accuracy of Probability Judgments

Across all participants, the average probability estimate was .57 (SD = .26). Within experimental conditions, average probability estimates ranged from .47 to .67 (see Table 1). Given that current trends indicate that at most about 4% of high school students who want to become doctors will actually do so, these estimates seem inordinately high. Evidence of this sort suggests that students' likelihood estimates are highly inaccurate even when rating the career attainment prospects of a stranger. This finding supports the inaccuracy explanation for overaspiration as opposed to the overconfidence explanation.

A simple application of Bayes' Theorem suggests that those students given the base rate of doctors generally failed to draw statistically accurate inferences from such

information. Students in the base rate / high academic success conditions reported an average probability estimate of 59% (SD = 26%) and students in the base rate / low academic success conditions reported an average estimate of 49% (SD = 26%). If we assume that 80% of doctors and 30% of non-doctors meet the stipulated criteria for high academic performance in high school, then from Bayes' Theorem the posterior probabilities of becoming a doctor are as follows: Pr (Doctor | high academic performance) = 10% and Pr (Doctor | low academic performance) = 1%.[2] If the assumed conditional probabilities are reasonable, then students in the base rate / high academic performance conditions produced estimates that were on average six times too high and students in the base rate / low academic performance conditions produced estimates that were nearly fifty times too high.

The above analysis can be generalized to any set of conditional probabilities. Figure 1 presents Bayesian posterior probabilities of becoming a doctor given various conditional probabilities for high academic performance. Even in the most extreme case wherein all doctors and nearly no non-doctors are assumed to meet the criteria for high academic success, the posterior probability computed from Bayes' Theorem is still only .30. Yet students in the base rate / high academic performance conditions produced estimates that were twice this value on average, and 85% of these participants reported estimates greater than .30. This suggests that students' estimates are inaccurate across a wide range of possible conditional probabilities. As such, the students in this study in general appear to have drawn statistically inaccurate inferences from the labor market information presented to them.

Effects of Information

A 2 x 2 x 2 ANOVA revealed that all three main effects of the treatment factors were statistically significant: base rate information produced lower probability estimates, F (1, 2242) = 28.20, $p < .0001$; higher probability estimates were associated with high academic success of the target subject, F (1, 2242) = 113.78, $p < .0001$; and higher probability estimates were associated with high social involvement of the target subject, F (1, 2242) = 4.31, $p < .05$. The effect size of the base rate main effect was relatively "small" (see Rosenthal & Rosnow, 1991), eta = .11. Academic information produced a "medium" effect size, eta = .22. The effect size for social information was so small as to likely be of no practical significance, eta = .04. The reliable effect of the base rate manipulation suggests that students' likelihood estimates become slightly more accurate when they are provided information about job availability.

No two way interactions from the 2 x 2 x 2 ANOVA were reliable, but the three way interaction was statistically significant, F (1, 2242) = 16.42, $p < .001$, eta = .08. This effect appears to reflect the fact that high vs. low social involvement of the target subject was associated with higher probability estimates in the low grades / base rate absent conditions but with lower probability estimates in the low grades / base rate present conditions (see Table 1). Since it is unclear what implications if any this effect has for the conceptual questions at issue, this interaction will not be decomposed any further.

The same 2 x 2 x 2 ANOVA was computed separately for each social class (lower, middle, upper) and race (white vs. non-white) category. The main effects of base rate and academic information were highly reliable in all cases ($ps < .01$). This demonstrates that the main effects of these factors found in the full model were not

artifacts of deviations from random assignment. A more complicated pattern was found for the effects of social information. High social involvement of the target subject was associated with higher probability estimates among students from upper SES communities, $F(1, 428) = 22.39$, $p < .001$, but there was no comparable main effect of social information among students from lower or middle SES communities ($ps > .25$). Similarly, the main effect of social information was significant among white students, $F(1, 1262) = 14.37$, $p < .001$, but not among non-white students, $F(1, 750) = .07$, $p > .75$. These results suggest that students from distinct backgrounds have very different ideas regarding the relationship between social skills and the likelihood of high status career attainment.

Effects of Student Characteristics

Data available from the larger study in which this experiment was embedded allowed an exploratory analysis of the effects of participants' characteristics on probability estimates. Ordinary least squares regression models were constructed to examine the effects of gender, race, social class, and academic achievement when effects of the experimental treatments were held constant. Since participants indicated their expected occupation at age 30 as part of the larger study, I was also able to examine whether students who expect to become doctors produced likelihood estimates different from those who expect other occupations.

Table 2 presents four progressively more inclusive regression models. Only those students with no missing data for any of the relevant variables were included in the

models. All independent variables except for social class and self-reported grade point average (GPA) were dummy coded; for the experimental factors the base rate information present, high academic success, and high social involvement conditions were coded 1. Coding for other dummy variables is indicated within the table.

It is clear from Table 2 that the effects of the experimental factors are robust when the other variables are also entered into the regression models. This once again suggests that small deviations from random assignment cannot account for the effects of the experimental manipulations. The experimental factors alone account for about 10% of the variance in probability estimates, with the additional factors explaining another 4% of the variance.

A number of student characteristics exerted significant influences on probability estimates exclusive of the effects of the experimental conditions. Female students (n = 750) on average produced higher probability estimates than male students (n = 565), and white students (n = 817) produced lower estimates than minorities (n = 498). Higher GPAs were associated with lower estimates. Finally, those students who themselves expect to become doctors (n = 163) reported greater probability estimates than those students who do not expect to become physicians (n = 1152).

Discussion

The overall pattern of results from this experiment supports the inaccuracy explanation for overaspiration. The participants in this study generally produced unrealistic probability judgments (given the expected frequency of doctors in the labor

force) despite the fact that they were rating the career attainment prospects of a stranger. Whatever influence self-confidence may have on patterns of overaspiration, then, such influence would seem to be underlain by the possession of inaccurate ideas about the difficulty of obtaining high status jobs.

The results of this experiment may also shed light on the causes of inaccurate judgments. The highly reliable effect of the base rate manipulation suggests that students' likelihood estimates become more realistic when they are provided information about job availability. Nonetheless, the Bayesian analysis of the estimates from students given base rate information demonstrates that judgments are still inaccurate on average even when students have such information. These findings in conjunction suggest both an information deficit and shortcomings in the ability to draw statistically accurate inferences from that information that is available. Both of these factors are likely to be causes of overaspiration with regard to career goals and expectations.

Why do students fail to draw more realistic inferences from information about job availability? One possible answer is that the students' responses are specific instances of the general phenomenon of "base rate neglect" – the tendency of subjects to rely on individuating information and ignore base rates when arriving at probability judgments (e.g., Nisbett & Ross, 1980; Tversky & Kahneman, 1974). Similarly, research has purported to have demonstrated an "anchoring and adjustment" bias whereby subjects who are provided with an arbitrary anchor for a likelihood estimate tend to make inadequate adjustments away from that anchor (Tversky & Kahneman, 1974). In the present case students may begin with an anchor of about 50/50 odds (since one could conceive of the problem as a binary choice -- i.e., the target either becomes a doctor or

not) and then adjust that estimate up or down depending on the information provided. The phenomena of base rate neglect and insufficient adjustment from an anchor might then explain why average probability estimates stayed near 50% instead of more accurately reflecting the base rate information provided to students. In sum, this line of explanation suggests that students draw inaccurate inferences in this case because humans are relatively inaccurate intuitive statisticians in general.

But the above explanation may not be entirely correct. More recent research has demonstrated conditions under which subjects do use base rate information accurately when arriving at likelihood estimates (see Gigerenzer, 1991). In particular, probability estimates tend to be accurate by statistical theory when both the base rate information provided to subjects and the probability judgments asked for are in the form of frequencies (Cosmides & Tooby, 1996). In other words, subjects' estimates of the likely frequencies of events differ dramatically from their subjective degrees of confidence in the occurrence of a single event.[1] Applied to the current case, students given the frequency of doctors in the labor force might have produced more accurate likelihood estimates if they had been asked to estimate the frequency of students just like the target subject who will actually become doctors. This format was not used because it is not ecologically valid: students assessing their own career prospects must compute subjective degrees of confidence in the likelihood of a single event. In sum, the frequentist view of the mind suggests that students may draw unrealistic inferences from base rate information not because humans are poor intuitive statisticians, but instead because intuitive statistics tend to break down when applied to likelihood estimates for the occurrence of single events.

Supplementary analyses revealed a number of other potentially interesting findings from this experiment. One might predict that students who themselves expect to become doctors will be more knowledgeable or attentive to diagnostic information and therefore produce more realistic likelihood estimates. Instead, such students produced higher probability estimates (across experimental conditions) than did students who reported other expected occupations. This finding is consistent with other evidence that adolescents tend to draw biased (self-serving) statistical inferences when reasoning about their own desired occupations (Klaczynski & Gordon, 1996).

Additional exploratory analyses revealed lower probability estimates among those students with higher self-reported grades, and higher probability estimates among women and minorities. These findings could be explored more fully in future research. Another productive avenue for future inquiry could be an investigation of the differential effects of social information about the target subject on the probability estimates of students from distinct racial and socioeconomic backgrounds. High social involvement of the target subject was associated with greater estimates of the likelihood of becoming a doctor among upper SES and white students, but not among lower and middle SES and non-white participants.

Conclusion

In summary, three main empirical conclusions seem warranted from the results of this experiment. First, high school students' probability judgments about high status career attainment are in general unrealistic. Second, probability judgments are responsive

to the presentation of information about job availability, but on average such judgments are still unrealistic even when this information is provided to students. Third, probability judgments are distorted in a self-serving manner when the students who rate the odds of career attainment themselves aspire to that same career. These findings suggest that inaccurate likelihood judgments explain adolescent overaspiration at least as well as any explanation based on overconfidence. They also suggest that this inaccuracy is attributable to both deficits of information and shortcomings in statistical reasoning.

These conclusions may have important implications for career counseling. They suggest, for example, that simply giving students labor market information may be insufficient to foster more realistic ideas about career development insofar as students draw inaccurate inferences from such information. Previous research within cognitive psychology suggests the need for a didactic technique that can impress upon students the logical relationship between frequency information and subjective degrees of confidence in the likelihood of single events. This may present a challenging task to educators who must walk a line between discouraging students' aspirations and ensuring that students have realistic ideas about the challenges and relative difficulty of obtaining high status jobs for which demand greatly exceeds supply.

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Author Note

James R. Roney, Committee on Human Development.

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Footnotes

[1] Sample sizes for computations using variables from the larger survey may vary because of missing data.

[2] Note to editor: I can include an appendix demonstrating this computation if desired. For the purpose of simplifying the analysis, this computation is collapsed across social information conditions.

[3] As an example, I would imagine that most people given the odds of winning a lottery would estimate that the long-run frequency of winners is equal to the stipulated odds. But consumers' behavior in buying lottery tickets (and their optimistic answers to queries from television news reporters) suggests that their subjective confidence in the likelihood of a single ticket winning does not correspond very well to their knowledge of long-term frequencies.

Table 1: Probability Judgments by Experimental Conditions

Social Information	Grades Information: Low Grades	Grades Information: High Grades
Baserate Information Absent		
Low Social		
M:	49.86	66.99
SD:	26.75	23.45
n:	257	416
High Social		
M:	57.29	65.62
SD:	23.89	28.27
n:	271	236
Baserate Information Present		
Low Social		
M:	50.36	56.45
SD:	26.82	26.9
n:	269	278
High Social		
M:	47.43	62.38
SD:	24.32	24.01
n:	300	223

Note. Mean values represent judgments of the probability that the target subject will actually become a doctor (range 0 to 100%).

Table 2: Regression Analyses for Probability Judgments

Variable Set	Model I	Model II	Model III	Model IV
Experimental Factors				
Base rate information	(-) 8.39***	(-) 7.69***	(-) 7.65***	(-) 7.66***
Target's social activity	3.49*	3.49**	3.70**	3.64**
Target's academic succes	14.13***	13.89***	13.92***	14.07***
Background Information				
Gender (Female = 1)		7.41***	7.83***	7.61***
Race (Non-white = 1)		6.17***	5.34***	4.77***
Social Class		0.44	0.69	0.55
Academic Information				
GPA (4 pt. Scale)			(-) 2.35**	(-) 2.67**
Career Expectations				
Student expects to be a doctor				5.66**
Total Adjusted R^2	0.104	0.135	0.14	0.144

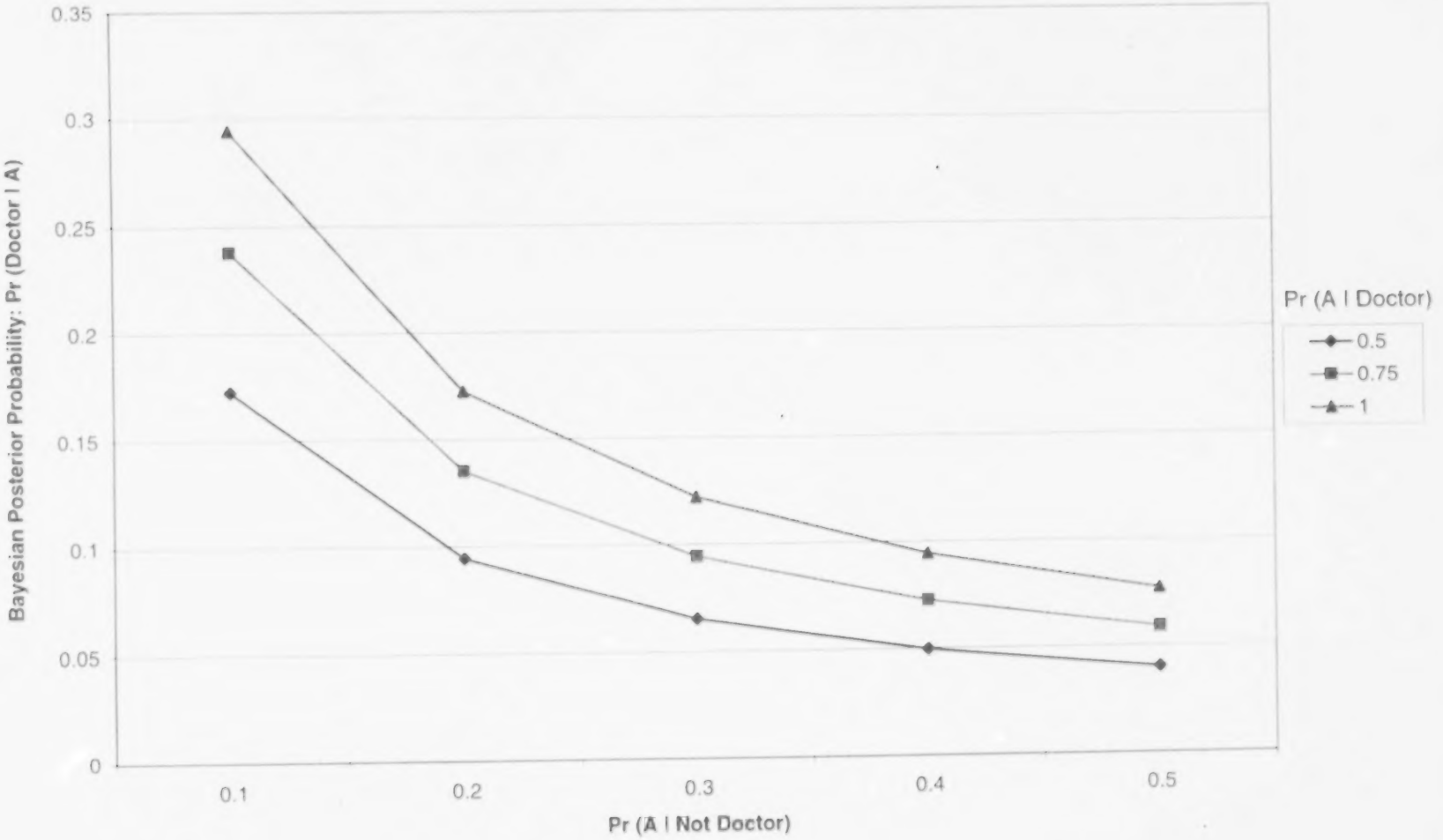
Note. Values within cells are unstandardized beta coefficients. Variables are entered simultaneously within each model.

N = 1315 for all models.

*p < .05. **p < .01. ***p < .001.

Figure Captions

Figure 1. Accurate probability estimates (by Bayes' Theorem) that a high academic performance target subject will become a doctor given various conditional probabilities for academic success. The letter A denotes high academic performance.


0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Bayesian Posterior Probability: Pr (Doctor I A)
0.1
0.2
0.3
0.4
0.5
Pr (A I Not Doctor)
Pr (A I Doctor)
0.5
0.75
1